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Date: 26 February 1996 **DOCKET FILE COPY ORIGINAL**

To: Secretary, FCC

Subject: Enclosed comments on RM-8737 (Wireless Bureau)

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FEB 27 1996

Dear Sir/Ms.,

Apparently, I was misinformed by other amateur radio operators about filing by E-mail; either I was given the wrong address or that was not appropriate in this proceeding. Unfortunately, I could not find the relevant news release or instructions for RM-8737 after a long and careful search of the WWW server. Alas, by the time I determined this, it was too late to get a package delivered by 17:30 today. While I have often submitted this kind of material in response to Draft Environmental Impact Reports/Statements, this is the first time I have submitted comments to the Commission. They use the postmark rather than the delivery date, so this was an additional form of confusion.

I have provided the original and nine copies [plus an extra for the reproduction department or other use, just in case] in addition to a copy sent by e-mail to your general information address yesterday (prior to the official deadline). Please accept this, as a late submission if necessary. I assure you that I will make a sincere effort to respect the Commission's procedures in the future.

Most respectfully submitted.

John Mock

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of)
)
Amendment of Part 97 of the) RM - 8737
Commission's Rules Governing)
the Amateur Radio Service to)
Facilitate Spread Spectrum)
Communications)

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COMMENTS ON ARRL'S REQUEST FOR RULE MAKING ON AMATEUR
SPREAD SPECTRUM COMMUNICATION

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SUMMARY and INTRODUCTION

The ARRL has proposed needed changes in Spread Spectrum operations in the Amateur Service. There may be potential problems with unrestricted use of Spread Spectrum emissions in the presently allowable amateur bands that need to be examined either before or as a part of the proposed actions. Some of the concerns are described herein and possible solutions are suggested in some cases. Requiring that Spread Spectrum emissions be subject to rules comparable to those currently applicable to repeaters and auxiliary stations, including local co-ordination, may mitigate most of these concerns.

Changing from overly restrictive rules regarding the types of SS emission transmissions to little or no restrictions raises the question of accountability in terms of message content. There may not be a good answer here, and the Commission may want to consider an intermediate step with regard to Section 97.331(c).

COMMENTS ON THE PROPOSAL

1. ... The Specific Benefits to the public to be gained from amateur use of spread-spectrum (SS) communications as determined by the Commission included the following: Reduced power density and concomitant reduction of interference to narrow band communication systems; 2) Significant improvements in communication under conditions with poor signal-to-interference ratio; 3) Improved communication performance in selective fading and multipath environments; and 4) Ability to accommodate more communication channels functioning simultaneously in the same spectrum than is possible using frequency

division multiple access exclusively. [2]

The problems mentioned in (4) are well known, at least, in urbanized area in the Amateur radio community. This would be a welcome improvement, but one that will take years to accomplish, given the amount of narrow-band equipment currently in use. The situation described in (3) is commonplace in California and is another area where improvement would be welcomed. While users of new equipment would enjoy the benefits described in (2), if the changes are not implemented carefully, non-users may suffer. This is a particularly concern for space and weak-signal operations. Given that Spread Spectrum is not widely in use by amateurs, we are not going to see improvements described in (1), but rather, the measures being proposed are to mitigate possible interference problems.

2. Since the time SS communications were first authorized in the Amateur Service in mid-1985, there have been some experimental amateur operations using SS techniques, but its use has not been widespread. The League believes that one significant reason for this reduced level of experimentation is due to limitations in the rules governing SS communications in the Amateur Service. The revised rules in the proposed appendix are intended to provide increased flexibility in the use of this mode, to encourage amateurs to experiment and use SS communications, to develop new techniques for increased spectrum efficiency using this mode, and to improve compatibility with narrow-band modes. [3]

There seems to be agreement in the amateur community that the rules for Spread Spectrum are overly restrictive. The important consideration here is whether the changes being proposed here are the right ones for all concerned.

4. ... Tests conducted by amateur groups have established that certain configurations of SS operations can, due to increased in-band noise, trigger amateur repeater inputs (if those repeaters are carrier-operated), but that potential interaction is easily avoided by selection of spread-spectrum parameters. 58 RR 2d at 329, and authorities cited therein at footnotes 4-9. There are potential interactions between SS and narrow-band modes in certain circumstances, depending on processing gain and the randomness of spreading codes, however. (2) There have been no reported instances whatsoever, in the League's experience, of interference to other radio services from amateur SS communications. (3) [4]

Unfortunately, it is difficult to determine from the text of this proposal what the nature of these tests were, and whether they address the concerns of all amateurs. Footnote (2) simply says that "potential interactions are no different than those involving other modes, and does not go into what these tests were. Footnote (3) contains a reference to 58 RR 2d at 330, but that discusses possible interfere to commercial TV, not amateur operations, and footnotes cited above are apparently in another document, as the RM-8737 proposal only contains footnotes 1-7. So the proposal discusses the effects of SS emissions on repeater operation, but it does not cover other modes. Does the Commission know what the likely effects on non-voice operation likely to be? What about space communications? While much of such operations are conducted using highly directional antennas, this is not necessarily the case. According to the ARRL Handbook, LEO (Low Earth Orbit) satellites are often used with non-directional ("J-pole") antennas utilizing mast-mounted pre-amplification to make up the gain difference. [5]

How will they be affected by Spread Spectrum operations, both in adjacent sub-bands, and within the same band?

If the purpose of the request for rule making is to allow the kinds of tests necessary to obtain this data, then the Commission should give serious consideration whether a rule making is the appropriate tool here. Would Special Temporary Authorities (STA) be the better way to conduct this testing? If the purpose is also to bring amateur Spread Spectrum rules up that provided by current technology, then perhaps the Commission should take a closer look how to provide suitable protection for existing users first.

It is the League's belief, and apparently that of Commission staff as well, that experimentation in the Amateur Service, and particularly further SS experimentation, should be accommodated by increased flexibility in the rules, and not by reliance on STAs. [6]

Special Temporary Authorities are not intended to routine operations, which is what seems to be evolving in Spread Spectrum. The STA in question was obtained originally to provide a test bed for CDMA, apparently for possible satellite operations,[7] and has been extended indefinitely, to other tests as well, in part, due to the inflexibility in the existing rules.[8] It is time to look at some of those limitations and see which ones are necessarily and appropriate, and which are holding back advances in the Amateur Service and elsewhere.

The League agrees that it is useful to relax somewhat the rules contained in Sections 97.305(b) and 97.311 governing amateur SS operation, to permit greater operating flexibility and the development of SS communications as a practical communications mode in the Amateur Service without adverse interaction with other modes. [9]

The important phrase here is "without adverse interaction with other modes". We need to have rules that will facilitate this. We also need to look at how Spread Spectrum operations affect other modes. For example, the human ear is very forgiving when it comes to noise, but how does it affect ATV? Moderate-speed digital communications, in the absence of error correcting coding, are not tolerant of noise, nor does the wide range of amateur implementations of these protocols handle retransmissions well, in part because of inter-operability problems. A more serious concern about raising the noise floor", which is the purported effect of Spread Spectrum, is to weak signal and space communications. There, it may be more than just an esthetic consideration, as it is likely to be in the repeater sub-bands. Those are sub-bands that we make efforts to keep quiet, so an increase in noise that might go unnoticed in the repeater sub-bands could be problem here. We could seriously degrade our ability to communicate effectively in areas where amateurs have been doing significant work.

So, to avoid adverse interactions, we need to know what these interactions are, and where Spread Spectrum operation is appropriate. Presumably, that is the intent of this Petition for Rule Making, that is, to extend the rules somewhat, so that we can find out how Spread Spectrum should be regulated. Although it may not be necessary or appropriate to state so in Part 97, per se, it should be clear from the process that this is an interim step to ascertain where Spread Spectrum should fit into the Amateur Service and that is not intended to be a final rule making.

... There have not been, in the League's experience, any established instances of actual interference to narrow-band amateur communications from SS communications. Tests conducted by amateur groups have established ...
[10]

This has been a problem in the 900 MHz band in the North [S.F.] Bay Area from amateur Spread Spectrum devices but with Part 15 devices. Glenn Elmore (N6GN), who is noted for his 2 Megabit/sec 10 GHz transceiver design, has been attempting to construct a high-speed IP/TCP network. His current design operates FSK in the 900 MHz band, and apparently one of his major problems has been with higher power Part 15 devices either at the same radio site, or aim at that site from other parts of the Bay Area. [11]

7. The first change proposed by the League is to permit brief test transmissions of SS emissions, as is permitted in Section 97.305(b) for other types of emissions, except that test transmissions using SS emissions would be limited to those frequency bands where SS emissions are authorized generally, as is the case with pulse modulation transmissions. [12]

Unfortunately, this does not address the issue of band planning. There is nothing here to protect space or weak signal operations. There are already provisions in Part 97 to restrict operation of repeaters [Section 97.205(b)] and auxiliary stations [Section 97.201(b)] in these sub-bands. For example, neither is permitted to operate in the beacon sub-bands [as described in Section 97.203(d)]. Serious consideration should be given to restricting both Spread Spectrum and pulse operations to sensitive sub-bands, as is currently done with repeater operation:

(b) A repeater may receive and retransmit only on the 10 m and shorter wavelength frequency bands except the 28.0-29.5 MHz, 50.0-51.0 MHz, 144.0-144.5 MHz, 145.5-146.0 MHz, 222.00-222.15 MHz, 431.0-433.0 MHz and 435.0-438.0 MHz segments. [13] [Section 97.205(b)]

Another possible oversight concerns the National Radio Quiet Zone. As it stands, both beacons [Section 97.203(e)] and repeaters [Section 97.205(f)] are restricted the National Radio Quiet Zone. It may be necessary to also regulate Spread Spectrum operation in this area. The National Radio Astronomy Observatory should be consulted in this matter to determine if their recommendations need to be incorporated into any rule changes.

The problems faced by Glenn Elmore and his colleagues, while not in the stations in amateur service, does illustrate a problem that we will be facing. That is, the compatibility among the various modes is likely to be more of localized issue than one that can be handled on a nationwide basis. For examples, some regions may choose to have two ATV channels in the 440 band. Others may decide that one ATV is enough for their needs, and that additional higher-speed digital channels are more important. [14] Another example is the recent with in the Amateur Service's Automatic Position Reporting System (APRS). Techniques that work well on the relatively level East Coast run into numerous anomalies in the hilly California, and that different communication strategies are needed in different area, based on terrain alone.[15] So we have differing patterns of usage due to local population differences and varying interest, and different propagation patterns due to local terrain.

What these local differences imply is that, just as in the world of repeaters, what works well in one part of the country may cause problems in another. Which is why we have local repeater coordinators, with regulations that are sensitive to local conditions. The same should apply to Spread Spectrum as well. In many areas, we are already doing local band planning with respect to both repeaters and widely accessible digital stations as well. We're seeing a trend towards combining the frequency co-ordination, for example, in the 440 band locally, Bob Wilkins (N6FRI) handles frequency co-ordination for both the regional repeater association (Northern Amateur Relay Council of California) and the North California Packet Association (NCPA). [16]

We are currently only expected to do frequency co-ordination for repeaters and auxiliary stations. We should seriously consider doing frequency coordination for Spread Spectrum stations as well, so we can make sure that they are in frequency ranges shared with compatible uses. As it stands, NCPA is already doing this on at least an informal basis in Northern California, and indeed there is already spectrum allocated for these kinds of operations at 900 MHz and above. [17]

Since Part 15 Spread Spectrum operations in the San Francisco Bay Area are already fairly widespread, this should be a good opportunity to see how Spread Spectrum emissions affect the Amateur Service. That is, examine usage patterns in the 900 MHz amateur band now, and before Part 15 Spread Spectrum was introduced, and compare that against the changes in the 440 MHz and/or 1.2 GHz amateur bands over the same time period. In some sense, one might suggest that the experiment has already been done, and it's merely a matter of examining the results.

Finally, restricting Spread Spectrum emissions is not a new idea. The ARRL suggests this in footnote (2) of their Request:

users of other modes. 47 C.F.R. #164#97.311(b). Conflicts are avoided by informal band planning and normal sharing considerations which work well in the crowded amateur bands. Avoidance of weak-signal subbands by SS operations is a reasonable preventative step. [18]

The Commission should give serious consideration making this a part of the rules, including suitable guard bands.

8. Second, it is proposed to amend Section 97.311(a) of the Rules to modify the requirement that SS communications be limited only to domestic communications. Amateur communications have always been permitted internationally between countries that permit it, and SS emissions should not be prohibited between United States amateurs and amateurs in countries where those emissions are permitted as well. [19]

When Spread Spectrum satellites go into operation, this will need to be addressed. It is already an issue where the FCC's jurisdiction is close to another, especially along the Canadian border. However, different countries may have different regulations, and we should respect the regulatory needs of other jurisdictions. Therefore, we may want to additionally constrain communications to those emissions acceptable under the regulations of both parties. In some sense, this is covered under Section 97.309(b):

(b) Where authorized by S S 97.305(c) and 97.307(f) of this Part, a

station may transmit a RTTY or data emission using an unspecified digital code, except to a station in a country with which the United States does not have an agreement permitting the code to be used... [20]

So, it may be sufficient to incorporate a reference to that section in the ARRL's proposed amendment to Section 97.311(a).

9. The reference in 97.311(b) to unintentional triggering of repeater inputs, a reference in the rules governing SS communications since 1984, is unnecessary because it is merely repetitive of existing definitions of "harmful interference" in the ITU Radio Regulations and in commission definitions and interpretations generally. Harmful interference for non-safety-of-life radio services does not include squelch breaks and repeater activation. (6) [21]

This may be the case, but most of the readers of Part 97 are not trained to interpret FCC regulations nor to understand the ITU regulations. Having this clarification in Section 97.311(b) avoids having either the FCC or Official Observers explain these definitions to well-meaning amateurs who utilize repeaters that do not employ modern squelch control techniques. (It may be worth noting here that these can be combined with carefully controlled carrier-controlled squelch to allow nearby amateurs with older equipment lacking CTSS to still access wide-coverage repeaters without permitting unintentional operations by distant users utilizing the same channel, such as is used by the W6APZ repeater in Palo Alto, California.) So, this change seems neither desirable nor useful. Removing this might also be construed as condoning unintentional triggering of properly equipped repeaters, which would discourage routine monitoring of repeaters primarily intended for emergency operations.

10. It is proposed to delete Subsections 97.311(c) and (d), in order to permit hybrid frequency-hopping (FH) and direct-sequence (DS) emissions, and spreading codes not currently permitted by the rules, but which are desirable. The current rules permit only two techniques, neither of which is optimal for sharing. There are newer codes, including those used by Part 15 device manufacturers, which have been optimized to avoid interaction with shared users. These could be used if the rules were more flexible. [22]

One of the basic principles of the amateur services is that:

[97.133] (a) No amateur station shall transmit ... [(4)] messages in codes or ciphers intended to obscure the meaning thereof, except as otherwise provided herein [for control purposes]. [23]

and this is stated more directly for digital modes:

[97.309(b)] ... RTTY and data emissions using unspecified digital codes must not be transmitted for the purpose of obscuring the meaning of any communication. [24]

The problem here is that, given foreseeable FCC funding, any serious enforcement efforts will primarily be with those associated with in the Amateur Service. It is not just a matter of identifying the station(s) involved in the communication, as suggested by the ARRL:

.... Nor will the changes create any difficulty with station identification, (7) or with protection of the Amateur Service from

commercial or unlicensed encroachment. The narrow-band identification requirement is sufficient, together with the documentation requirement in Section 97.311(e) of the Rules, to permit the degree of monitoring of SS activities of amateurs necessary to protect the Service. ... [25]

It is also important to be able to determine whether the information being transmitted is in compliance with Part 97. As it stands, what is required under Section 97.311(e) is station records which include description of the transmissions which are basically sufficient to decode it, and

(3) A general description of the type of information being conveyed (voice, text, memory dump, facsimile, television, etc.); [26]

Without sophisticated equipment, it is, for all practical purposes, not possible for a knowledgeable amateur to determine compliance. A further complication is that one of the major uses for Spread Spectrum is likely to be as network components, both for network backbone links, for gateways to allow amateur stations to reach other stations and amateur services, and perhaps to connect on a limited basis to the Internet. When a station is doing packet forwarding, it may not be possible to determine the type of information being conveyed. So we have two problems here: Amateurs are not permitted to do what is obviously needed for modern networking, and, at the same time, we cannot easily determine compliance with the regulations we have. This is difficult dilemma and there may not be any easy answers.

Now, one of the major complaints being heard locally is that amateurs cannot do what unlicensed operators can do with Part 15 devices. That is a major issue that does need to be addressed. One way of dealing with that problem is to add an additional subsection to Part 97.311(c) such as the following proposal:

[97.311(c) Only the following types of SS emission transmissions are authorized...]

(3) Spreading techniques utilized by widely available Part 15 type-accepted devices, which can readily be received by such devices.

[Text proposed here]

This will allow determination of compliance by a nearby station without opening the door to transmissions that neither that in the Amateur Service nor the Commission is in a position to monitor and regulate.

It may also be reasonable to allow Spread Spectrum emissions from published, well documented and easily reproducible devices within the construction abilities of ordinary, proficient amateurs. But going from very tight regulation to essentially no controls on the form of Spread Spectrum emissions seems unwise at this time, unless such transmissions are made subject to Section 97.311(f)(3):

(f) When deemed necessary by an EIC to assure compliance with this Part, a station licensee must:

...

(3) Maintain a record, convertible to the original information (voice, text, image, etc.) of all spread spectrum communications transmitted.

That is to say, continue the existing regulations, perhaps extending them somewhat to be consistent with the existing STA's, and then permit arbitrary Spread Spectrum emissions with mandatory compliance (rather upon demand) with Section 97.311(f)(3). Current disk prices and backup storage technology make this requirement considerably less onerous than when the rules were originally proposed. This may be one way that the Commission could encourage experimentation necessary to determine what the permanent Spread Spectrum rules should be without potentially creating a situation such as developed with the Citizen Band during the 1970's and 1980's.

11. Finally, the proposed appendix would amend Section 97.311(g), to provide for automatic transmitter power control which would limit output power to that which is required for the communication, when more than one watt of transmitter power is used. This is a simple matter to accomplish technically, and it will insure compliance with Section 97.313(a) of the rules, which requires the use of minimum transmitter power. It will also minimize any potential for interference to other amateur stations and insure maximum spectrum efficiency. [28]

This may make sense for terrestrial communications, but almost certainly more than one watt will be necessary for space communications. This may not be such a simple matter technically. On the other hand, power level control has been a problem in amateur space communication, so this may be a wise idea. This may be an area where a STA may still be the best tool and so the proposed rule may well be an appropriate one.

CONCLUSION

The ARRL is acting in a timely and responsible manner in requesting changes in the rules governing Spread Spectrum emissions in the Amateur Service. The fact that an unlicensed and technically naive individual (at least in terms of RF technology) can operate in a manner that a competent amateur cannot without Special Temporary Authority is an unfortunate situation that does not cast either the Amateur Service or the Commission in a positive light. The rule changes requested by the ARRL have considerable merit, but the Commission should consider these changes very carefully to minimize adverse effects on other modes in the Amateur Service, and to avoid possible problems with abuse of amateur privileges.

Specific concerns described herein involve noise-sensitive modes, especially weak-signal operation, beacons, and space communications; band planning, both local and throughout the FCC's jurisdiction; and compliance in terms of message content. Most of these concerns can be met by restricting Spread Spectrum operations in the comparable manner to repeaters with regard to permissible sub-bands and local co-ordination, as implied in one of the ARRL's footnotes.[29]

Assuring compliance in terms of message content is more difficult, and the Commission should consider this problem very carefully before changes the rules regarding the types of SS emissions authorized for the amateur service. Going from overly restrictive rules to no restrictions may not necessarily be in the best interests of either the Amateur Service or the Commission.

Therefore, the Commission is respectfully urged to consider the ARRL's

request for a rule making very carefully, neither accepting the proposal wholesale nor rejecting it entirely.

Respectfully submitted,

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FOOTNOTES:

- [1] A second generation computer professional with 25 years of experience, the author did pioneering work with one of the first Network UNIX systems on the ARPANET, on font design for the Xerox Graphics Printer (grandfather of the Apple LaserWriter), real-time digitally synthesized music, and has implemented numerous network protocols, include AX.25 and APRS.
- [2] American Radio Relay League [ARRL], "Petition For Rule Making" [RM-8737], ("Amendment of Part 97 of the Commission's Rules Governing the Amateur Radio Service to Facilitate Spread Spectrum Communications"), December 12, 1995. Sec. I.1
- [3] *ibid.*, Sec. I.2
- [4] *ibid.*, Sec. II.4
- [5] American Radio Relay League, "The ARRL Handbook for Radio Amateurs" (1993 Edition), pp. 23-26 - 23-29.
- [6] ARRL [RM-8737], Sec. II.6, para. 2.
- [7] Jim Horning, "Amateur Radio Spread Spectrum Communications Page" (<http://www.sp.nps.navy.mil/ss/index.html>) [Naval Postgraduate School], January, 1996.
- [8] Robert A. Buaas (K6KGS), Letter to Mr. Ralph A. Haller, Chief Private Radio Bureau, April 30, 1994.
- [9] ARRL [RM-8737], Sec. II.6, para. 4.
- [10] *ibid.*, Sec. II.4
- [11] Bob Wilkins (N6FPI), Frequency Coordinator, NARCC. Private communication, 1995.
- [12] ARRL [RM-8737], Sec. III.7
- [13] 47 CFR Part 15, Section 97.205(b).
- [14] Bob Wilkins. Private communication, 1995.
- [15] *ibid.*
- [16] North California Packet Association, "North California Packet Association" (<http://www.ccnnet.com/~rwilkins/ncpa.html>), January 9, 1995. Para. 4.
- [17] *ibid.* Para. 5-6.
- [18] ARRL [RM-8737], Footnote 2.
- [19] ARRL [RM-8737], Sec. III.8
- [20] 47 CFR Part 15, Section 97.309(b).
- [21] ARRL [RM-8737], Sec. III.9
- [22] *ibid.* Sec. III.10, para. 1.
- [23] 47 CFR Part 15, Section 97.113(a).
- [24] *ibid.* Section 97.309(b).
- [25] ARRL [RM-8737], Sec. III.9
- [26] 47 CFR Part 15, Section 97.311(e)(3).
- [27] *ibid.*, Section 97.311(f).
- [28] ARRL [RM-8737], Sec. III.11
- [29] *ibid.*, Footnote 3.
-